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Gear Types, Seasonal Distribution of Effort, and Bycatch of the Smelt Fishery In The Southern Gulf of St. Lawrence

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GEAR TYPES, SEASONAL DISTRIBUTION OF EFFORT, AND BYCATCH OF THE SMELT FISHERY IN THE SOUTHERN GULF OF ST. LAWRENCE

by

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ABSTRACT

A questionnaire was mailed to 1491 holders of smelt licences in the southern Gulf of St. Lawrence to determine timing, gear usage, and bycatch in the 4T smelt fishery. Completed responses were received from 464 fishermen. About half of the respondents fished smelts in winter only, a quarter in fall only, and the remainder fished in both fall and winter. Winter fishing was particularly important in northeastern New Brunswick, which is the most important smelt fishing area in the southern Gulf. Smelts were fished with box nets, bag nets, and gillnets, with some fishermen on the Gaspé Peninsula also using seines. In general, fishermen tended to use gillnets and some box nets in the fall, and box nets in the winter. Only a minority of fishermen used bag nets in either season. Herring, blueback herring, and alewives were reported as bycatch in all regions and gear types. Bycatches were more commonly reported in fall than winter. The occurrence of juvenile herring in smelt bycatch suggests that catch rates of juvenile herring in smelt gear might serve as an index of pre-recruit year-class strength, which would allow prediction of future recruitment to the commercial herring fishery.

RESUME

Un questionnaire fut envoyé à 1491 titulaires de permis de pêche à l'éperlan de la zone sud du Golfe Saint-Laurent. Le but du questionnaire était de déterminer les saisons pendant lesquelles la pêche se pratique, le type d'engins utilisés, et les prises accessoires de cette pêche. Quatre cent soixante et quatre questionnaires ont été remplis et retournés. A peu près la moitié des répondants pêchait l'éperlan uniquement en hiver, un quart pêchait uniquement en automne, et le restant pêchait dans les deux saisons. La pêche d'hiver avait une importance particulière dans le nord-est de Nouveau-Brunswick, dont la pêche à l'éperlan est la plus importante du sud du Golfe. Les éperlans étaient pris avec les filets à réservoir, les filets à poche, et les filets maillants, et en Gaspésie, avec les seines. En général, les pêcheurs avaient tendance à utiliser les filets maillants et quelques filets à réservoir en automne, et les filets à réservoir durant l'hiver. Les filets à poche étaient utilisés par une minorité des pêcheurs dans les deux saisons. Le hareng, l'alose d'été, et le gaspareau étaient capturés comme prises accessoires dans toutes les régions et avec tous les engins de pêche. Les prises accessoires étaient plus fréquentes durant l'automne que durant l'hiver. L'apparence de harengs juvéniles dans la pêche à l'éperlan suggère que le taux de capture des jeunes harengs dans les engins de pêche à l'éperlan peut possiblement servir d'indicateur de l'importance des classes d'âge pré-recrues. Ceci pourrait permettre la prédiction du recrutement dans la pêche commerciale du hareng.

INTRODUCTION

The smelt (Osmerus mordax) fishery in the southern Gulf of St. Lawrence is a significant part of the economy of the Maritime provinces and eastern Quebec. The revenue from the smelt fishery is particularly important to many people because smelts are caught in the fall and winter, when there is little income from other fisheries.

This report presents results of a questionnaire sent to holders of smelt licences in the southern Gulf. The purpose of the questionnaire was to gain basic information on the distribution of smelt fishing effort in the area, the timing of the fishery, and the type of gear used. This information updates and supplements the thorough study by McKenzie (1964).

An important additional objective was to learn about the bycatch of other species in smelt gear. The bycatch of juvenile Atlantic herring (Clupea harengus) was of particular interest, because the distribution and movements of young herring in the Gulf of St. Lawrence are poorly known, and information on bycatch of young herring in the smelt fishery may prove to be helpful in predicting the abundance of adult herring. Bycatch of blueback herring (Alosa aestivalis) and alewives (A. pseudoharengus), whose biology is poorly known in the Maritime region (but see Messieh 1977, Dadswell 1985, Johnston and Cheverie 1988) was also investigated.

METHODS

Questionnaires were sent to all holders of smelt licences in the southern Gulf of St. Lawrence in November and December 1987. The area included Prince Edward Island, the Gulf coasts of Nova Scotia and New Brunswick, and the Gaspé Peninsula of Quebec. Questionnaires were accompanied by a covering letter which explained the purpose of the program, and a pre-stamped return envelope. Both English and French versions of the questionnaire were sent to licence-holders in New Brunswick and Quebec. Licence-holders in Nova Scotia and Prince Edward Island with French surnames were sent questionnaires in both official languages. Other licence-holders in Nova Scotia and Prince Edward Island received English questionnaires only.

The questionnaire (Appendix 1) asked if the respondent fished smelts, where he fished them and what gear types he used (box nets, bag nets, or gillnets). For each gear type, the respondent was asked when he fished, and whether he caught herring, blueback herring, or alewives (referred to as gaspereau in the questionnaire) as a bycatch. Because of the physical

similarity of blueback herring and alewives (MacLellan et al. 1981), drawings of the three species were included with the questionnaire, together with a brief account of how to distinguish them. Questions referred to a fisherman's experience in the smelt fishery in general, rather than to a specific year.

For purposes of assigning season of fishing, the end of fall and the beginning of winter was taken as late December, the usual time when smelt fishing areas freeze over.

RESULTS AND DISCUSSION

Response rate

In all, 1491 questionnaires were mailed (Table 1). Fifty-eight percent of the questionnaires went to addresses in eastern New Brunswick, reflecting the large number of smelt fishermen there. Prince Edward Island accounted for 28% of smelt licence-holders in the southern Gulf, and the remainder were divided between Nova Scotia (10%) and the Gaspé Peninsula (4%).

We received 464 completed questionnaires from respondents, for a response rate of 31.1%. Twenty-four respondents indicated that they did not fish smelts, leaving 440 questionnaires to analyse. Many holders of smelt licences in the southern Gulf renew their licences each year but do not fish smelts. Unfortunately, the number of respondants indicating they do not fish smelts cannot be used to estimate the number of inactive licences, because it is likely that a higher proportion of active fishermen responded to the questionnaire than inactive fishermen. It is also not possible to determine the number of active smelt fishermen in the southern Gulf from purchase slip records, because Canadian Fishing Vessel numbers, normally used to identify individual fishing operations on purchase slips, are often absent from these records.

Timing of fishing

The smelt fishery in the southern Gulf of St. Lawrence is prosecuted in the fall and winter. In Gulf waters of the Maritime Provinces, where the fishery is regulated by the Department of Fisheries and Oceans, the gillnet season opens at the beginning of October and the season for box and bag nets opens in mid-October. The season for all gears closes in early to mid March. Smelt fishing in the Gaspé Peninsula is regulated by the Quebec Ministère de L'Agriculture, des Pêcheries et de l'Alimentation. In the Gaspé Peninsula smelt fishing is permitted only between 1 September and 31 December, except in the area between Pointe à la Croix and Carleton at the western end of the Bay of Chaleur in Districts Q14 and Q15, where the season is from 1 September to early March. Open seasons in the Gaspé Peninsula apply to all gear types. Seasons in all areas may vary from year to year.

The distribution of smelt fishing effort between fall and winter varies geographically (Fig. 1). In the Gaspé Peninsula, fishermen answering the questionnaire were about evenly divided between the fall and winter fishery, and only one person reported that he fished both seasons. On the North Shore and Northeastern New Brunswick, winter fishing predominates, with the majority of fishermen reporting that they fished only in the winter. Along the Northumberland Strait (Southeastern New Brunswick, Nova Scotia and South Shore P.E.I.), both the fall and winter fisheries are important, and many fishermen fish in both seasons. On the North Shore of P.E.I., the fall fishery predominates, although many fishermen fish in both seasons. For the southern Gulf as a whole, about half of the fishermen fish in winter only, about a quarter fish in fall only, and a quarter fish in both seasons.

Gear types

Box nets, bag nets, and gillnets are permitted in the Gulf smelt fishery of the Maritime Provinces. Bag nets consist of a bag-shaped net which is attached to stakes and which floats with the tide or current, catching fish without meshing them. Box nets are made of netting arranged in a box into which fish are guided by a leader. In Quebec, beach seines are permitted in addition to box, bag, and gillnets.

The type of gear used by fishermen varies with the season and with the region (Fig. 2). In the Gaspé Peninsula, gillnets are the major gear type in the fall, but box nets predominate in the winter at the western end of the Bay of Chaleur. Several fishermen in the Gaspé also use seines in the fall.

In the North Shore and Northeastern New Brunswick, most fishermen use gillnets in the fall and box nets in the winter. Prince Edward Island fishermen tend to follow a similar pattern, although those on the south side of the Island also use box nets extensively in the fall. In Southeastern New Brunswick, box nets predominate in both seasons. Nova Scotian fishermen favour gillnets in both seasons, although bag nets are used extensively in winter. The overall tendency in the southern Gulf is to use gillnets and some box nets in the fall, and to use box nets in winter.

In general, fishermen who use gillnets use them in larger numbers than other gear types. The average number of gillnets per fisherman who used them was 9.9 (Table 1). This compares to 5.5 box nets per fishermen for those using box nets, and 3.5 bag nets per fisherman for those using bag nets.

Bycatch

Fishermen responding to the questionnaire indicated that herring, blueback herring, and alewives occurred as bycatch in all regions and in all gear types (Table 2, Figs. 3-8). In general, bycatches were much more frequently reported in the fall fishery than in the winter fishery. For example, juvenile herring were reported by 23 to 46% of fishermen in the fall, depending on gear type, but in winter only 0 to 19% of fishermen reported catching juvenile herring. Winter catches of blueback herring and alewives were rare, and winter bycatches of these species were reported from only a few districts.

In all regions and for all species, the proportion of fishermen reporting bycatches in bag nets was higher than the proportion reporting bycatches in box nets (Table 1). This suggests that bag nets may be more effective at taking bycatch than box nets. Gillnets appeared to be least effective in taking bycatch; this gear type had the lowest reported rate of bycatch in all but one region and season. The low herring bycatch in gillnets may be due to their inefficiency in catching 0 and 1 year old herring, which would generally be too small to be gilled in smelt gillnets.

Inspection of the maps in Figs. 3-8 suggests that juvenile herring, blueback herring, and alewives might be more abundant in some areas of the southern Gulf than in others. In fall, herring are frequently taken in Miramichi Bay, the narrowest part of Northumberland Strait near Cape Tormentine, and certain parts of the north side of Prince Edward Island. Blueback herring and alewives are reported most often from the fall smelt fishery in Prince Edward Island and Nova Scotia, and occur less frequently in New Brunswick (Figs. 5 and 7).

CONCLUSIONS

This survey has confirmed that smelt fishing is a widespread and important activity in the southern Gulf of St. Lawrence. Both fishing effort (Table 1) and landings (Appendix 3) are widely distributed throughout the southern Gulf, but the greatest concentration of fishing activity occurs in northeastern New Brunswick. This area, particularly Miramichi Bay, has been the centre of the southern Gulf smelt fishery for most of this century (Appendix 3, McKenzie 1964). The economic value of the smelt fishery is heightened because it occurs at a time of year when most other fisheries are dormant. The smelt fishery is also more accessible than most other fisheries because the capital cost of necessary equipment is lower than for many commercial fisheries.

The survey also shows that juvenile herring and other species are commonly taken as bycatch in smelt gear. This suggests that a program to monitor bycatch of young herring in

smelt nets might be a practical way to measure annual changes in the abundance of young herring. Herring that are caught in smelt gear are usually one or two years old, whereas herring caught in the herring fishery are three years old or older. If the abundance of young herring could be measured by monitoring bycatches in smelt gear, the future strength of herring populations could be predicted more accurately. This would allow biologists to make better recommendations on herring management and harvests.

Although many fishermen reported that they commonly find juvenile herring in their smelt gear, the majority indicated that these bycatches never occurred. Indeed several fishermen wrote on their questionnaires that they had never seen a herring in forty or more years of fishing smelts. It appears that some smelt fishing sites are often visited by herring, but herring rarely if ever occur in other sites.

Alewives and blueback herring were less frequently reported as bycatch than herring, but were nevertheless widespread, especially in the fall. Although an identification guide was provided with the questionnaire, the occurrence of these species as indicated by the questionnaire must be interpreted with caution. Alewives and blueback herring are very similar externally, and can be reliably distinguished only by the colour of the lining of the body cavity or by scale characteristics. Thus reports of the occurrence of these species are subject to error. Reports of herring, on the other hand, can be considered reliable because they can be readily separated from alewives and blueback herring by their lack of ventral scutes, a distinction which is commonly known to fishermen.

ACKNOWLEDGEMENTS

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Table 1

Some characteristics of the smelt fishery in the southern Gulf of St. Lawrence, from responses to a questionnaire.

Region	Statistical Districts	Number of licence-holders	Number of fishermen completing questionnaire	Number fishing with box nets	Average number of box nets per fisherman	Number fishing with bag nets	Average number of bag nets per fisherman	Number fishing with gillnets	Average number of gillnets per fisherman
Gaspé Peninsula*	Q6,Q9,Q10, Q11,Q12,Q13 Q14,Q15	63	22	8	2.1	6	2.0	6	4.2
North Shore of New Brunswick	63,64,65	121	55	41	3.2	6	5.0	13	6.2
Northeastern New Brunswick	66,67,68,70, 71,73	424	162	123	7.4	26	6.7	35	13.0
Southeastern New Brunswick	75,76,77,78, 80	314	87	67	4.2	20	1.9	20	11.8
Gulf Nova Scotia	45,46,10,11, 12,13,3,2	150	57	10	2.6	19	1.7	37	3.6
North Shore of P.E.I.	92,93,95,96, 88	281	56	27	6.1	0	-	36	15.2
South Shore of P.E.I.	82,83,85,86, 87	138	25	12	5.1	6	2.2	11	7.3
Total**		1491	464	288	5.5	83	3.5	158	9.9

*4 fishermen from the Gaspé Peninsula also fish smelts with seines.

**Responses which did not say where the person fished are not included in these totals.

Table 2

Number of fishermen reporting juvenile herring, blueback herring, and alewives as bycatch in the smelt fishery of the southern Gulf of St. Lawrence.

Region	Fall fishery									Winter fishery								
	Fishermen catching bycatch in box nets			Fishermen catching bycatch in bag nets			Fishermen catching bycatch in gillnets			Fishermen catching bycatch in box nets			Fishermen catching bycatch in bag nets			Fishermen catching bycatch in gillnets		
	No.	%	N*	No.	%	N	No.	%	N	No.	%	N	No.	%	N	No.	%	N
Juvenile herring bycatch																		
Gaspé Peninsula**	1	100.0	1			0	4	80.0	5	1	14.3	7	1	20.0	5	0	0.0	2
North Shore N.B.	0	0.0	2			0	3	27.3	11	3	8.1	37	4	80.0	5	0	0.0	1
Northeastern N.B.	4	22.2	18	5	45.5	11	6	20.0	30	13	11.7	111	2	16.7	12	0	0.0	4
Southeastern N.B.	12	37.5	32	1	16.7	6	0	0.0	17	1	2.1	47	0	0.0	12	0	0.0	5
Gulf Nova Scotia	1	14.3	7	5	83.3	6	3	15.8	19	0	0.0	2	2	18.2	11	0	0.0	13
North Shore P.E.I.	6	42.9	14			0	9	30.0	30	0	0.0	14			0	0	0.0	5
South Shore P.E.I.	3	60.0	5	1	33.3	3	2	50.0	4	0	0.0	6	0	0.0	3			0
Total	27	34.2	79	12	46.2	26	27	23.3	116	18	8.0	224	9	18.8	48	0	0.0	30
Blueback herring bycatch																		
Gaspé Peninsula	0	0.0	1			0	0	0.0	5	1	14.3	7	0	0.0	3	0	0.0	2
North Shore N.B.	0	0.0	2			0	1	11.1	9	1	3.0	33	0	0.0	1	0	0.0	1
Northeastern N.B.	1	7.7	13	2	25.0	8	1	3.8	26	1	1.1	93	0	0.0	9	0	0.0	2
Southeastern N.B.	4	14.3	28	1	16.7	6	1	6.7	15	1	2.4	42	0	0.0	12	0	0.0	5
Gulf Nova Scotia	1	16.7	6	5	83.3	6	4	25.0	16	0	0.0	2	1	9.1	11	0	0.0	11
North Shore P.E.I.	7	43.8	16			0	5	19.2	26	1	6.7	15			0	0	0.0	3
South Shore P.E.I.	1	25.0	4	1	33.3	3	1	33.3	3	0	0.0	6	0	0.0	3			0
Total	14	20.0	70	9	39.1	23	13	13.0	100	5	2.5	198	1	2.6	39	0	0.0	24
Alewife bycatch																		
Gaspé Peninsula	1	100.0	1			0	2	40.0	5	0	0.0	7	0	0.0	3	0	0.0	2
North Shore N.B.	0	0.0	2			0	2	22.2	9	0	0.0	33	0	0.0	2	0	0.0	1
Northeastern N.B.	4	25.0	16	2	22.2	9	2	7.4	27	3	2.9	102	1	9.1	11	0	0.0	2
Southeastern N.B.	6	19.4	31	2	33.3	6	1	6.7	15	1	2.3	43	0	0.0	11	0	0.0	5
Gulf Nova Scotia	0	0.0	6	2	40.0	5	2	12.5	16	0	0.0	2	0	0.0	10	1	9.1	11
North Shore P.E.I.	6	40.0	15			0	8	29.6	27	0	0.0	13			0	0	0.0	3
South Shore P.E.I.	3	75.0	4	1	25.0	4	1	33.3	3	0	0.0	5	0	0.0	4			0
Total	20	26.7	75	7	29.2	24	18	17.6	102	4	2.0	205	1	2.4	41	1	4.2	24

*N is the number of fishermen fishing with the indicated gear in the indicated season, who answered whether or not they caught bycatch.

**4 fishermen in the Gaspé reported that they fish smelts with seines in the fall. In this fishery 2 fishermen reported juvenile herring (66.7%, N=3), and there were no reports of blueback herring or alewife bycatches (0% and N=1 for both species).

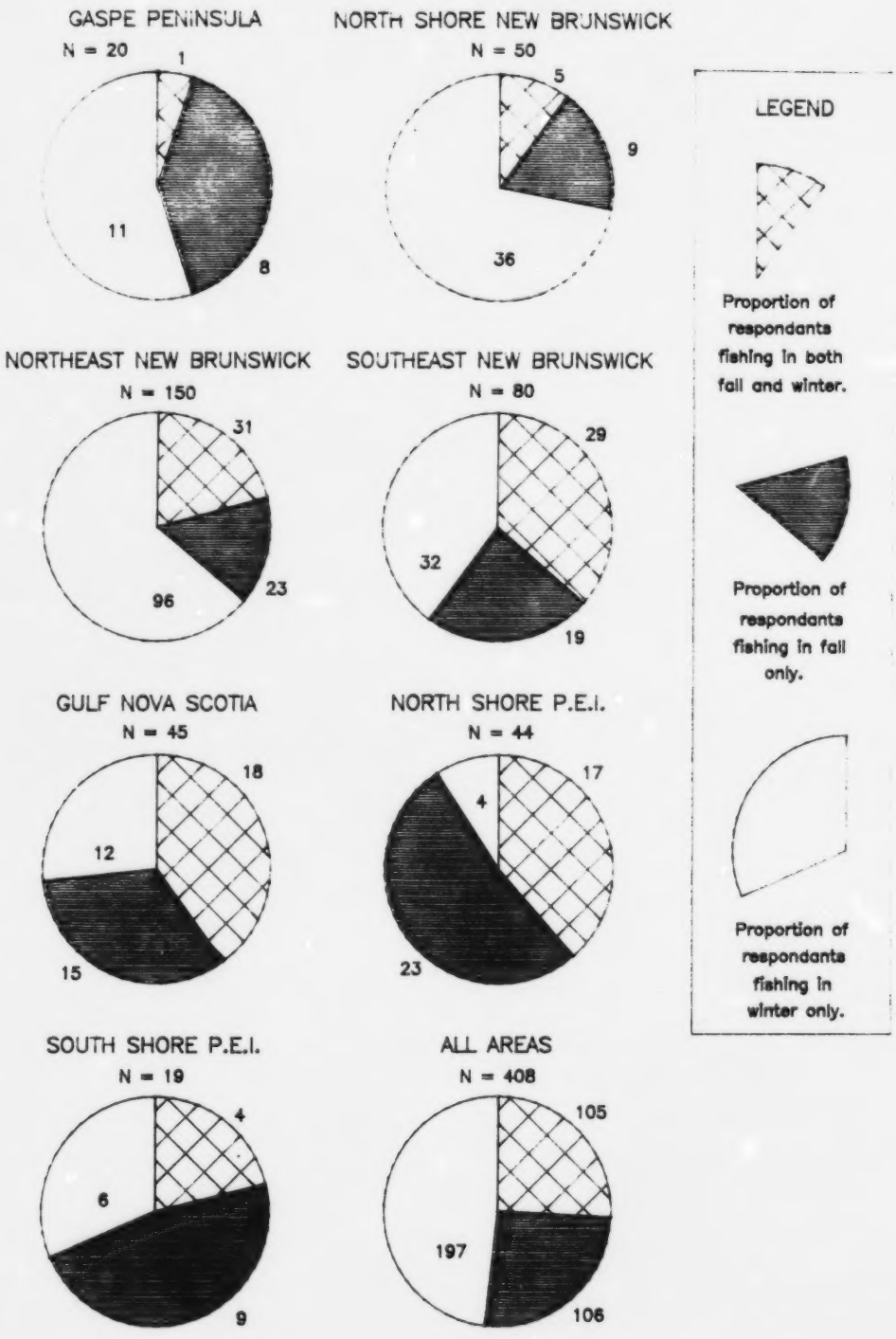


Fig. 1 - The distribution of fishing effort between fall and winter in the smelt fishery in the southern Gulf of St. Lawrence.

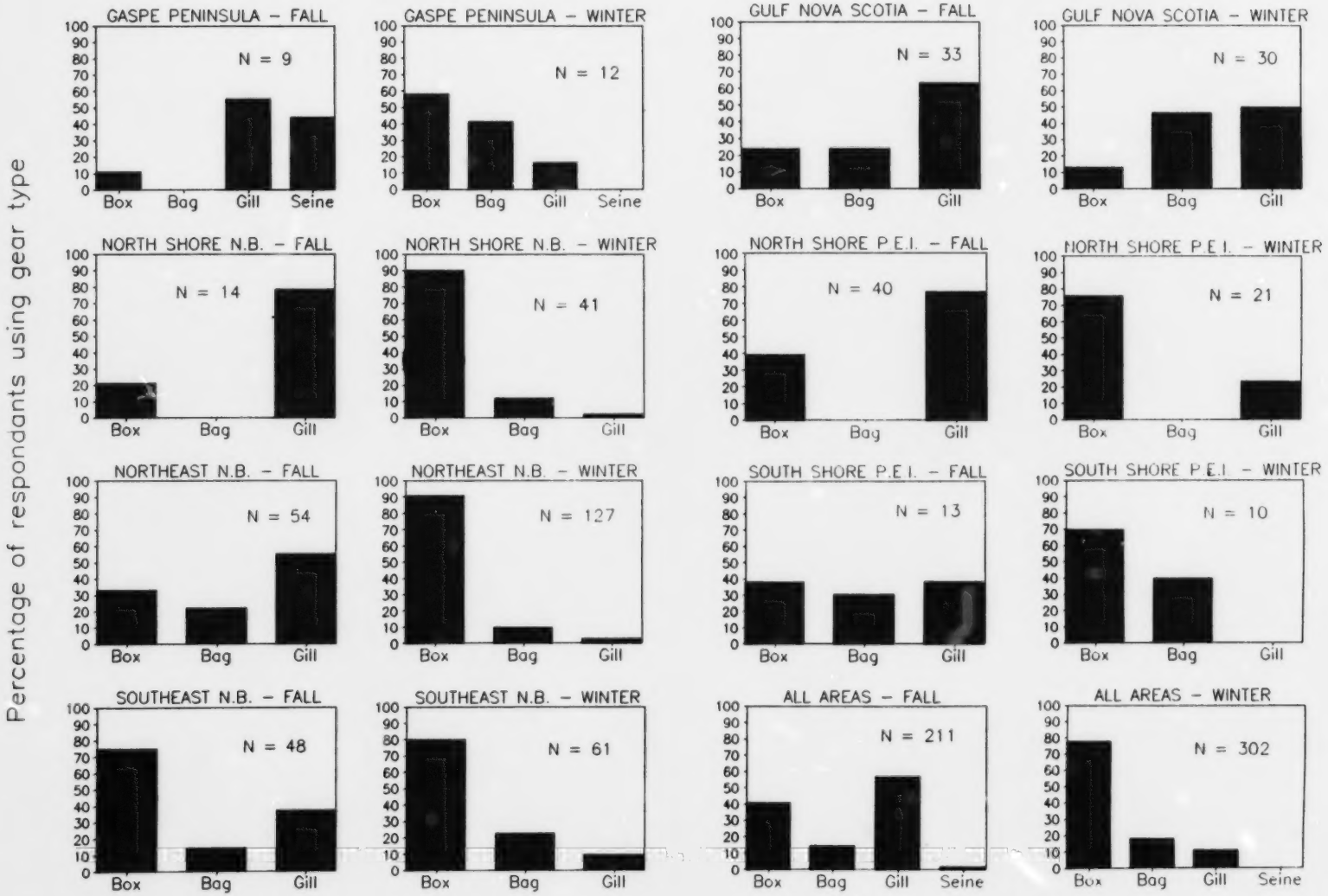


Fig. 2 – Percentage of fishermen using various gear types in the fall and winter smelt fishery in the southern Gulf of St. Lawrence.

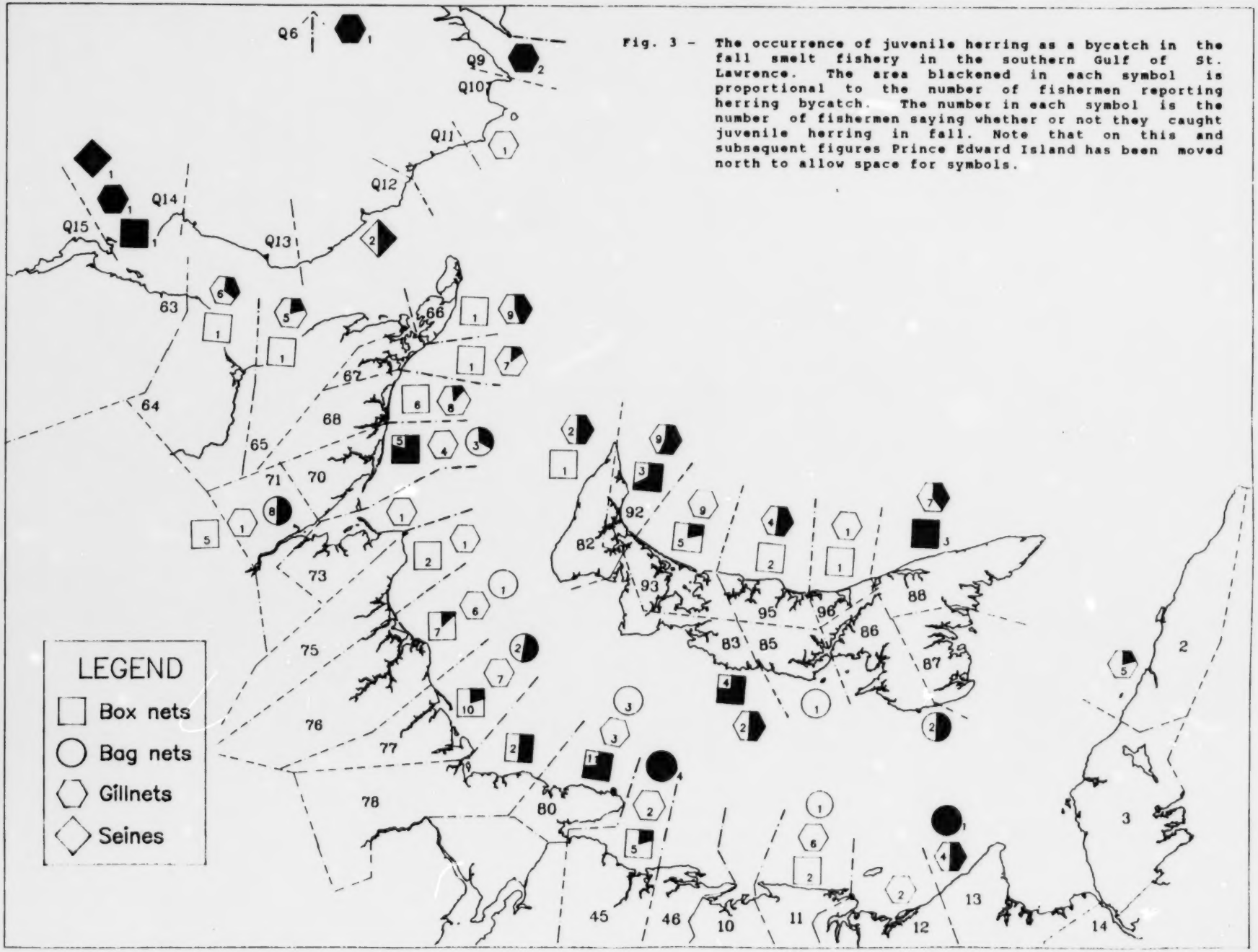


Fig. 3 - The occurrence of juvenile herring as a bycatch in the fall smelt fishery in the southern Gulf of St. Lawrence. The area blackened in each symbol is proportional to the number of fishermen reporting herring bycatch. The number in each symbol is the number of fishermen saying whether or not they caught juvenile herring in fall. Note that on this and subsequent figures Prince Edward Island has been moved north to allow space for symbols.

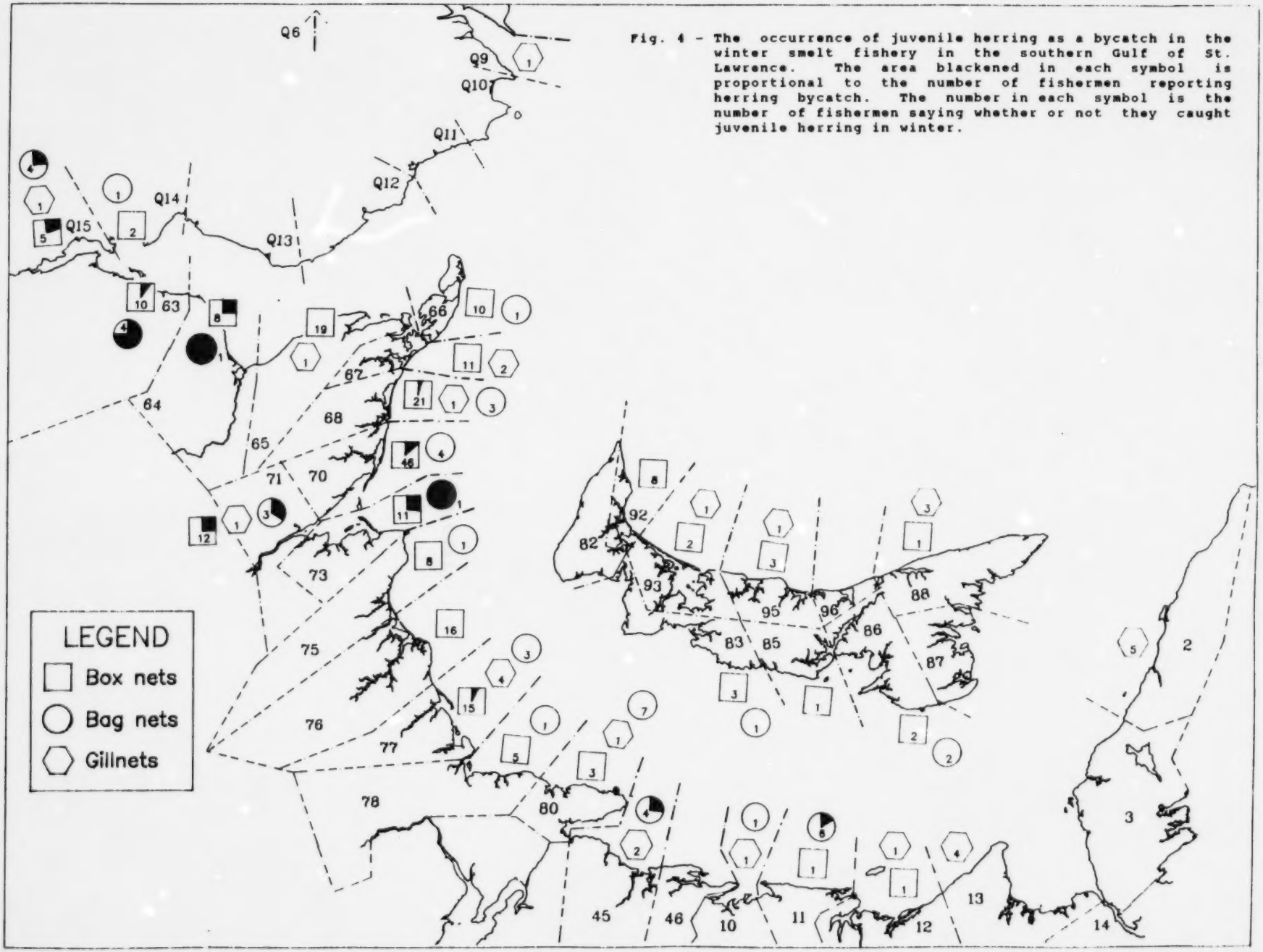


Fig. 4 - The occurrence of juvenile herring as a bycatch in the winter smelt fishery in the southern Gulf of St. Lawrence. The area blackened in each symbol is proportional to the number of fishermen reporting herring bycatch. The number in each symbol is the number of fishermen saying whether or not they caught juvenile herring in winter.

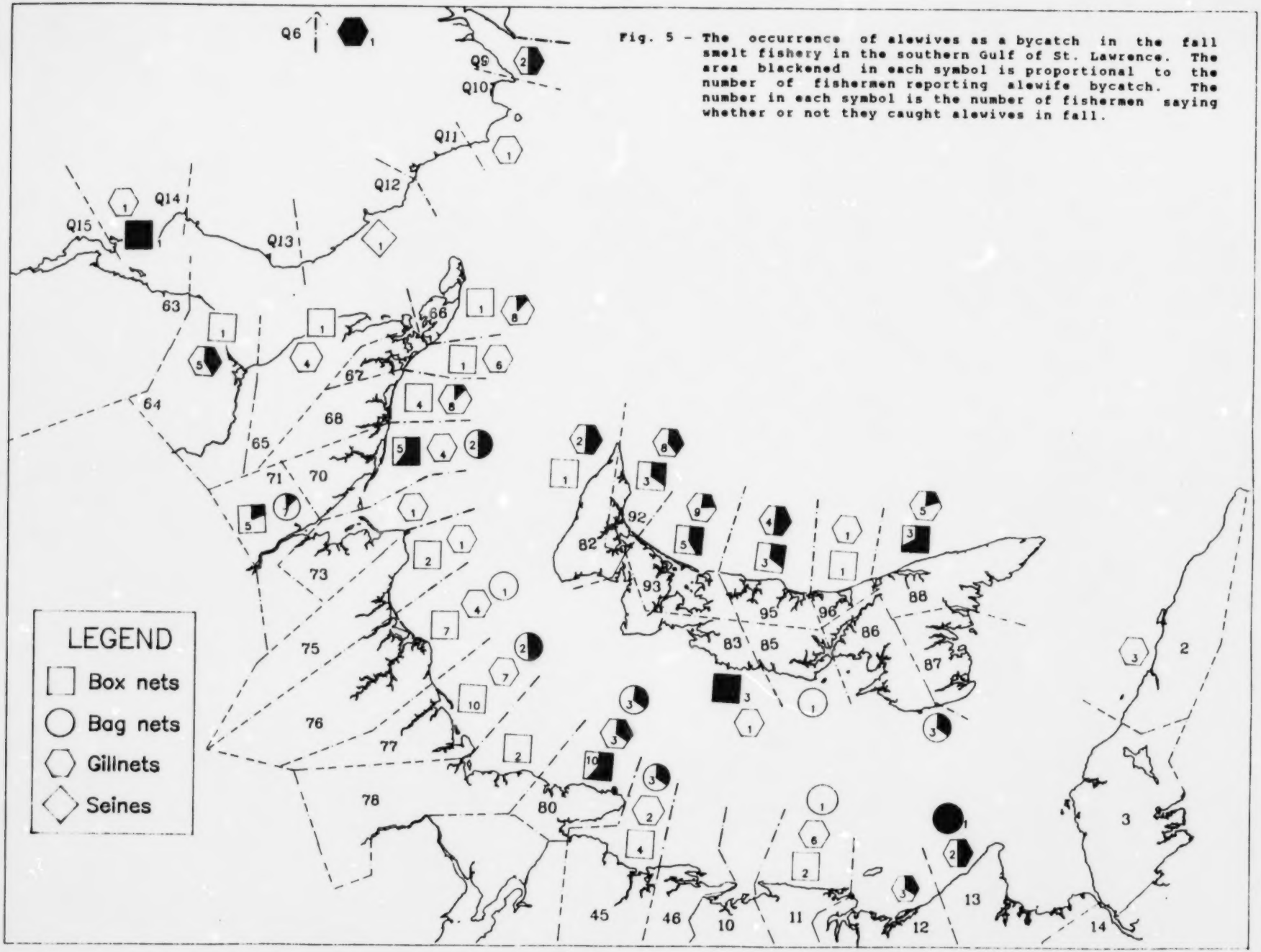


Fig. 5 - The occurrence of alewives as a bycatch in the fall smelt fishery in the southern Gulf of St. Lawrence. The area blackened in each symbol is proportional to the number of fishermen reporting alewife bycatch. The number in each symbol is the number of fishermen saying whether or not they caught alewives in fall.

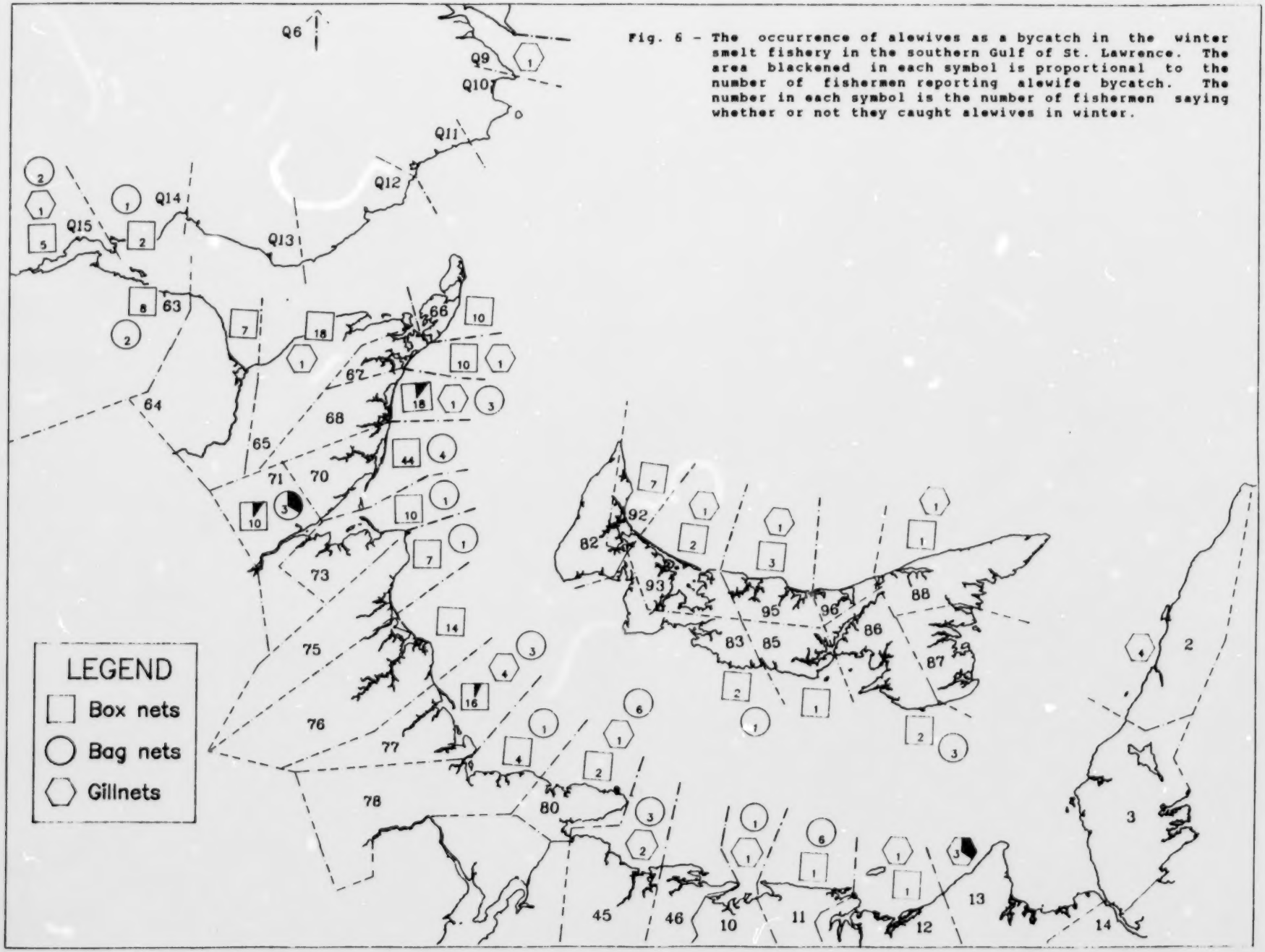


Fig. 6 - The occurrence of alewives as a bycatch in the winter smelt fishery in the southern Gulf of St. Lawrence. The area blackened in each symbol is proportional to the number of fishermen reporting alewife bycatch. The number in each symbol is the number of fishermen saying whether or not they caught alewives in winter.

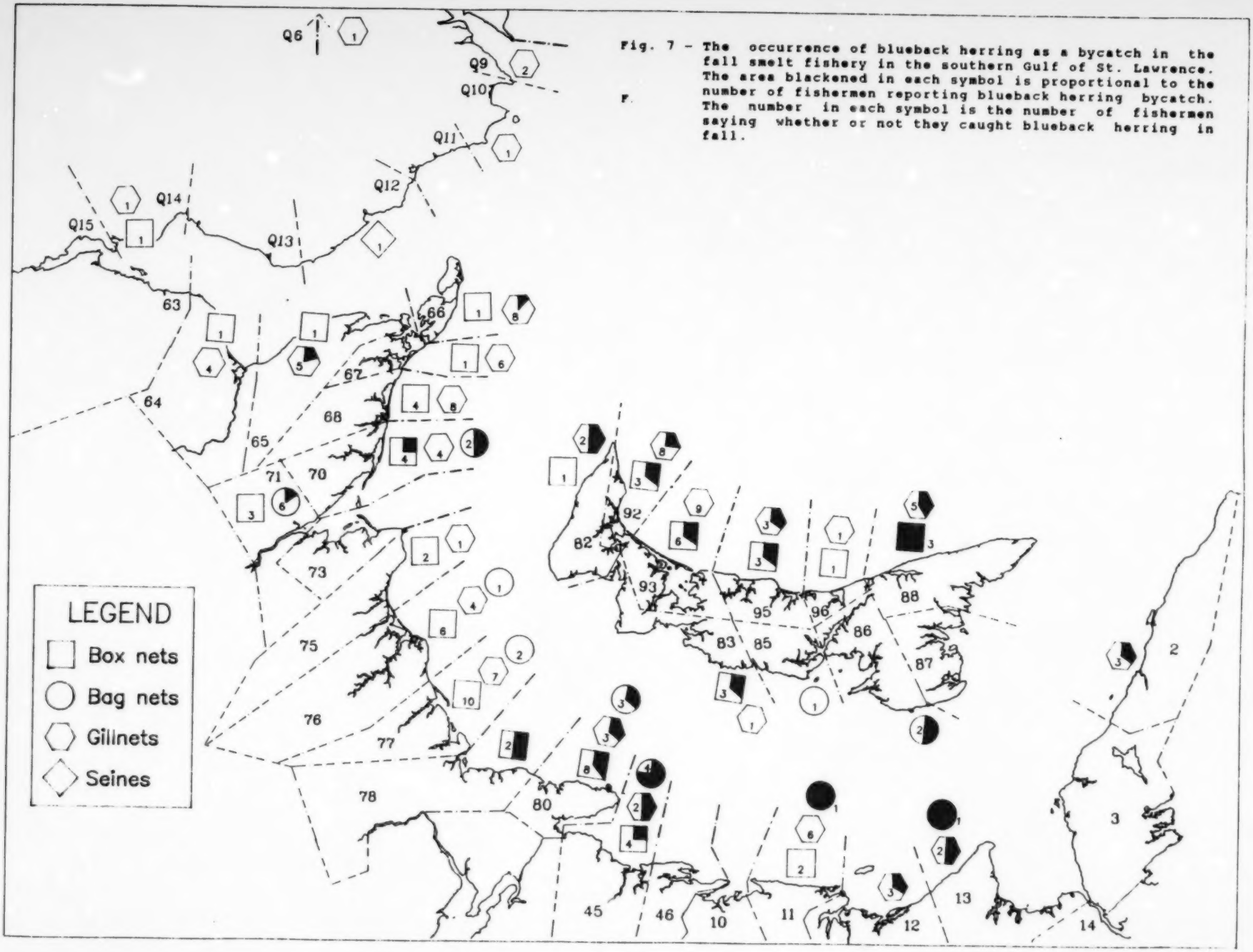


Fig. 7 - The occurrence of blueback herring as a bycatch in the fall smelt fishery in the southern Gulf of St. Lawrence. The area blackened in each symbol is proportional to the number of fishermen reporting blueback herring bycatch. The number in each symbol is the number of fishermen saying whether or not they caught blueback herring in fall.

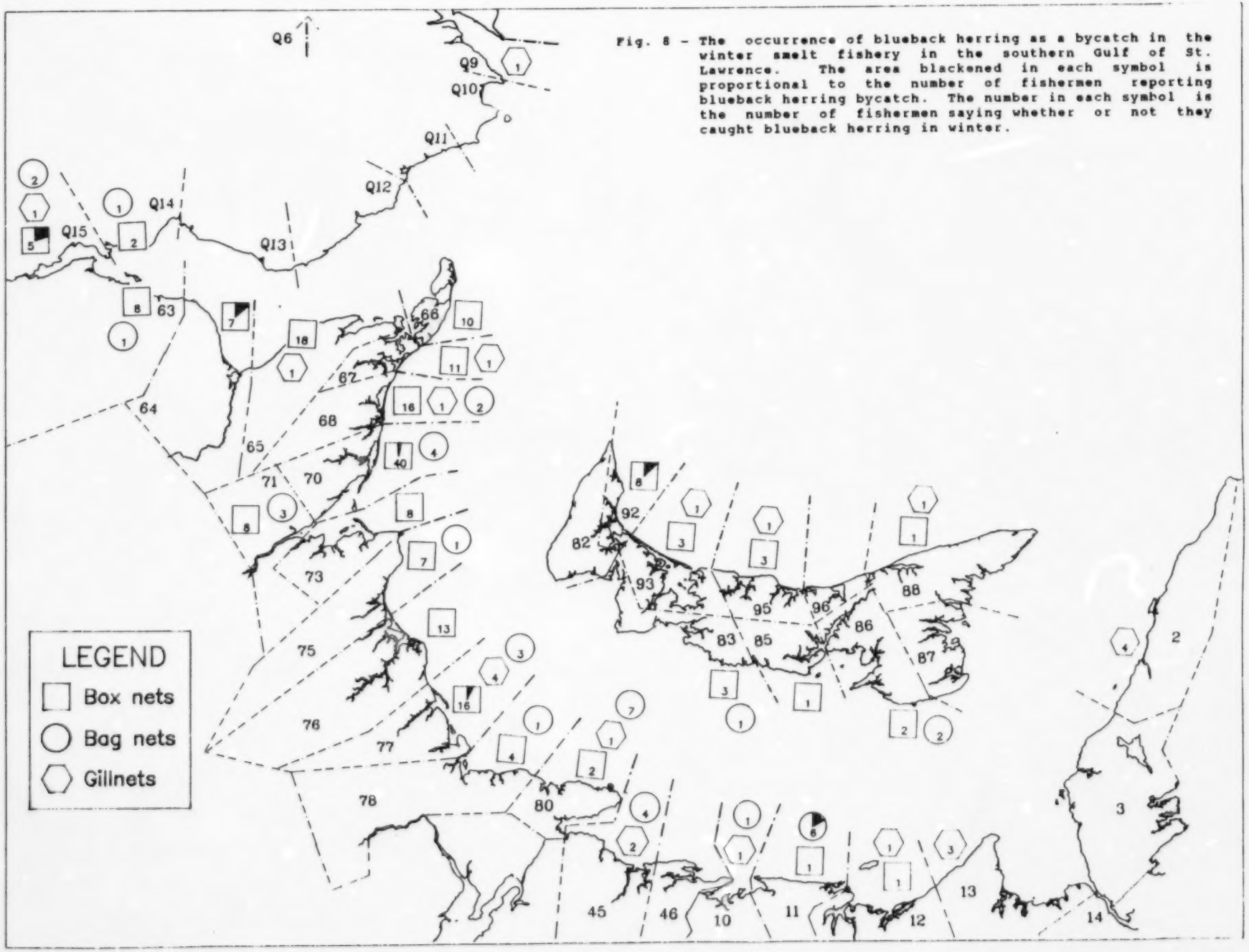


Fig. 8 - The occurrence of blueback herring as a bycatch in the winter smelt fishery in the southern Gulf of St. Lawrence. The area blackened in each symbol is proportional to the number of fishermen reporting blueback herring bycatch. The number in each symbol is the number of fishermen saying whether or not they caught blueback herring in winter.

Appendix 1.

Questionnaire sent to holders of smelt licences in the southern Gulf of St. Lawrence.

SMELT FISHERMAN QUESTIONNAIRE

The Department of Fisheries and Oceans wants to learn to what extent juvenile and adult herring winter in the Gulf of St. Lawrence. This questionnaire, addressed to smelt fishermen in the southern Gulf, will help us learn more about the habits of this important species.

In answering these questions, please keep in mind that gaspereau and blueback herring, as well as Atlantic herring, may be caught in smelt gear. Some simple ways of identifying these species are given overleaf.

Have you fished smelts in the last several years? yes ____ no___
If yes, where do you do most of your fishing? _____

_____

Do you fish smelts with box traps? yes ____ no ____
If yes, how many box traps do you set per year? _____
When do you set and lift these traps each year?

set _____ lift _____
Do these traps ever catch herring (yes ___ no ___), blueback herring (yes ___ no ___), or gaspereau (yes ___ no ___)?
For each of these species that are caught, please indicate the size range of fish caught, how frequently you catch them, and when you usually catch them.

_____

_____

Do you fish smelts with gill nets? yes ____ no ____
If yes, how many gill nets do you set per year? _____
When do you set and lift these nets each year?

set _____ lift _____
Do these nets ever catch herring (yes ___ no ___), blueback herring (yes ___ no ___), or gaspereau (yes ___ no ___)?
For each of these species that are caught, please indicate the size range of fish caught, how frequently you catch them, and when you usually catch them.

_____

_____

Do you fish smelts with bag nets? yes ____ no ____
If yes, how many bag nets do you set per year? _____
When do you set and lift these nets each year?

set _____ lift _____
Do these nets ever catch herring (yes ___ no ___), blueback herring (yes ___ no ___), or gaspereau (yes ___ no ___)?
For each of these species that are caught, please indicate the size range of fish caught, how frequently you catch them, and when you usually catch them.

Appendix 1 (continued).

Other comments: _____

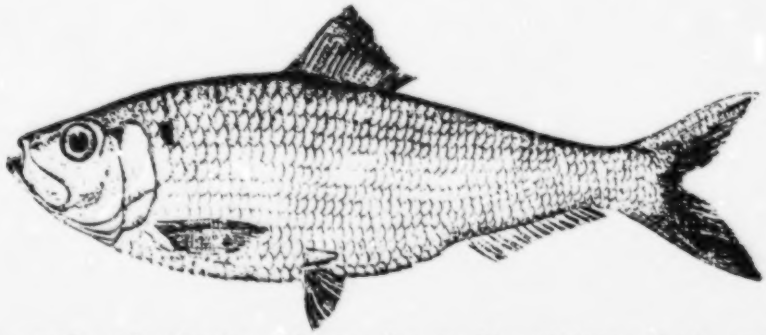
_____

_____

Name: _____

Thank you for your assistance

Gaspereau



Gaspereau spend much of their lives in salt water, but enter freshwater streams to spawn. They have saw-like scales along the the belly, and deeper bodies than blueback herring and Atlantic herring. The lining of the body cavity is pale to dusky.

Blueback Herring

Blueback herring, like gaspereau, spawn in freshwater streams. Like gaspereau, they have saw-like projections on the belly, but these are not as stiff as those of gaspereau. Their bodies are not as deep as those of gaspereau. The surest way to tell bluebacks from gaspereau is by their blackish lining of the body cavity. This lining is much darker than that of gaspereau.

Atlantic Herring

Appendix 2

Characteristics of the smelt fishery in the southern Gulf of St. Lawrence, by statistical district.

District	No. licence holders	No. respondents	No. fishing smelts	Box nets						Bag nets						Gillnets					
				No fishing with box nets	Number of box nets per fisherman[a]		No. (and percent) fishing box nets in fall	No. (and percent) fishing box nets in winter	N[b]	No. fishing with bag nets	Number of bag nets per fisherman		No. (and percent) fishing bag nets in fall	No. (and percent) fishing bag nets in winter	N*	No. fishing with gillnets	Number of gillnets per fisherman		No. (and percent) fishing gillnets in fall	No. (and percent) fishing gillnets in winter	N*
					x̄	N					x̄	N					x̄	N			
Gaspé Peninsula																					
Q8	1	1	1	0		0	0	0	0	0		0	0	0	0	1	4.0	1	1(100.0)	0 (0)	1
Q8	1	0																			
Q9	4	2	2	0		0	0	0	0	0		0	0	0	0	2	5.5	2	2(100.0)	1 (50.0)	2
Q10	5	1	1	0		0	0	0	0	0		0	0	0	0	1	2.0	1	1(100.0)	0 (0)	1
Q11	6	0																			
Q12[c]	6	4	3	0		0	0	0	0	1	1.0	1	0	0	0	0		0	0	0	0
Q13	1	0																			
Q14[c]	25	5	5	3	2.3	3	1 (33.3)	2 (66.7)	3	1	2.0	1	0 (0)	1(100.0)	1	1	5.0	1	1(100.0)	0 (0)	1
Q15	14	9	9	5	1.9	5	0 (0)	5(100.0)	5	4	2.3	4	0 (0)	4(100.0)	4	1	3.0	1	0 (0)	1(100.0	1
Total	63	22	21	8	2.1	8	1 (12.5)	7 (87.5)	8	6	2.0	6	0 (0)	5(100.0)	5	6	4.2	6	5 (83.3)	2 (33.3)	6
North Shore New Brunswick																					
63	32	16	15	12	2.7	10	0 (0)	10(100.0)	10	5	3.3	3	0 (0)	4(100.0)	4	0		0	0	0	0
64	14	14	14	9	5.1	8	2 (22.2)	8 (88.9)	9	1	10.0	1	0 (0)	1(100.0)	1	7	4.8	5	6(100.0)	0 (0)	6
65	75	25	24	20	2.7	20	1 (5.0)	19 (95.0)	20	0		0	0	0	0	6	7.3	6	5 (83.3)	1 (16.7)	6
Total	121	55	53	41	3.2	38	3 (7.7)	37 (94.9)	39	6	5.0	4	0 (0)	5(100.0)	5	13	6.2	11	11 (91.7)	1 (8.3)	12
Northeastern New Brunswick																					
66	69	17	15	10	5.4	9	1 (10.0)	10(100.0)	10	1	3.0	1	0 (0)	1(100.0)	1	9	12.9	9	9 (100.0)	0 (0)	9
67	51	21	20	12	5.3	12	1 (8.3)	11 (91.7)	12	0		0	0	0	0	9	17.3	7	7 (87.5)	2 (25.0)	8
68	43	30	28	21	6.1	20	6 (28.6)	21(100.0)	21	3	10.7	3	0 (0)	3(100.0)	3	9	15.1	8	8 (100.0)	1 (12.5)	8
70	111	60	60	52	8.4	44	5 (10.0)	49 (98.0)	50	9	7.8	8	3 (37.5)	5 (62.5)	8	5	8.4	5	4 (100.0)	0 (0)	4
71	66	22	22	16	9.9	15	5 (31.3)	14 (87.5)	16	12	5.2	10	9 (75.0)	3 (25.0)	12	2	2.0	1	1 (50.0)	1 (50.0)	2
73	64	12	12	12	6.7	12	0 (0)	11(100.0)	11	1	4.0	1	0 (0)	1(100.0)	1	1	2.0	1	1 (100.0)	0 (0)	1
Total	424	162	157	123	7.4	112	18 (15.0)	116 (96.7)	120	26	6.7	23	12 (48.0)	13 (52.0)	25	35	13.0	31	30 (93.8)	4 (12.5)	32
Southeastern New Brunswick																					
75	43	12	10	8	4.9	7	2 (25.0)	8(100.0)	8	1	1.0	1	0 (0)	1(100.0)	1	1	20.0	1	1(100.0)	0 (0)	1
76	75	22	22	19	5.5	16	8 (42.1)	16 (84.2)	19	1	2.0	1	1(100.0)	0 (0)	1	7	10.0	6	6(100.0)	0 (0)	6
77	104	24	23	19	4.2	18	10 (52.6)	16 (84.2)	19	4	2.0	3	2 (50.0)	3 (75.0)	4	7	21.8	4	7(100.0)	4 (57.1)	7
78	31	7	7	7	2.6	7	4 (57.1)	6 (85.7)	7	2	4.0	2	1 (50.0)	2(100.0)	2	1		0	1(100.0)	1(100.0)	1
80	61	22	21	14	3.2	13	12 (92.3)	3 (23.1)	13	12	1.5	11	3 (33.3)	8 (88.9)	9	4	2.5	4	3(100.0)	1 (33.3)	3
Total	314	87	83	67	4.2	61	36 (54.5)	49 (74.2)	66	20	1.9	18	7 (41.2)	14 (82.4)	17	20	11.8	15	18(100.0)	6 (33.3)	18
Gulf Nova Scotia																					
2	20	13	13	0		0	0	0	0	0		0	0	0	0	13	3.4	11	6 (60.0)	7 (70.0)	10
3	3	0																			
10	2	2	2	0		0	0	0	0	1	2.0	1	0 (0)	1(100.0)	1	1		0	0 (0)	1(100.0)	1
11	38	10	8	2	1.0	2	2(100.0)	1 (50.0)	2	7	1.1	7	1 (16.7)	6(100.0)	6	7	4.9	7	6(100.0)	0 (0)	6
12	15	7	6	1	3.0	1	0 (0)	1(100.0)	1	0		0	0	0	0	6	3.6	6	3 (75.0)	1 (25.0)	4
13	27	9	7	1		0	0 (0)	1(100.0)	1	1	2.0	1	1(100.0)	0 (0)	1	7	3.4	7	4 (66.7)	4 (66.7)	6
14	3	0																			
45	29	16	16	6	3.2	5	6(100.0)	1 (16.7)	6	10	2.0	10	6 (66.7)	7 (77.8)	9	3	1.8	2	2 (66.7)	2 (66.7)	3
46	13	0																			
Total	150	57	52	10	2.6	8	8 (80.0)	4 (40.0)	10	19	1.7	19	8 (47.1)	14 (82.4)	17	37	3.6	33	21 (70.0)	15 (50.0)	30
North Shore P.E.I.																					
88	92	12	11	4	3.3	4	3 (75.0)	1 (25.0)	4	0		0	0	0	0	8	4.6	7	7(100.0)	3 (42.9)	7
92	68	14	13	10	9.7	9	3 (33.3)	9(100.0)	9	0		0	0	0	0	11	23.6	11	10(100.0)	0 (0)	10
93	73	18	15	7	3.0	7	6 (85.7)	3 (42.9)	7	0		0	0	0	0	10	13.3	9	9(100.0)	1 (11.1)	9
95	37	10	9	5	6.6	5	3 (60.0)	3 (60.0)	5	0		0	0	0	0	6	16.5	6	4(100.0)	1 (25.0)	4
96	11	2	1	1	5.0	1	1(100.0)	0 (0)	1	0		0	0	0	0	1	5.0	1	1(100.0)	0 (0)	1
Total	281	56	49	27	6.1	26	16 (61.5)	16 (61.5)	26	0		0	0	0	0	36	15.2	34	31(100.0)	5 (16.1)	31
South Shore P.E.I.																					
82	38	3	3	2	2.5	2	1 (50.0)	1 (50.0)	2	0		0	0	0	0	2	9.0	2	2(100.0)	0 (0)	2
83	57	12	12	7	5.1	7	4 (66.7)	3 (50.0)	6	1	4.0	1	0 (0)	1(100.0)	1	5	15.0	2	3(100.0)	0 (0)	3
85	7	2	2	1		0	0 (0)	1(100.0)	1	1	1.0	1	1(100.0)	0 (0)	1	1	2.0	1	0	0	0
86	8	5	5	2	7.5	2	0 (0)	2(100.0)	2	4	2.0	3	3 (75)	3 (75.0)	4	0		0	0	0	0
87	28	3	3	0		0	0	0	0	0		0	0	0	0	3	2.7	3	0	0	0
Total	138	25	25	12	5.1	11	5 (45.5)	7 (63.6)	11	6	2.2	5	4 (66.7)	4 (66.7)	6	11	7.3	8	5(100.0)	0 (0)	5
Unknown		7	6	4	4.3	3	2 (66.7)	1 (33.3)	3	3	1.0	3	2(100.0)	1 (50.0)	2	0		0	0 (0)	0 (0)	0
Grand Total[d]	1491	464	440	288	5.5	264	87 (31.1)	236 (84.3)	280	83	3.5	75	31 (41.3)	55 (73.3)	75	158	9.9	138	121 (90.3)	33 (24.6)	134

[a] Number of nets per fishermen based on responses of fishermen using one or more nets of that type.

[b] Sample size for number of respondents fishing gear types in fall and winter.

[c] Two licence-holders fish with seines in fall.

[d] Excludes responses from unknown locations.

Appendix 3.

Landings (tonnes) of smelt from the Gulf of St. Lawrence coasts of the Maritime Provinces, 1974-1987.

Statistical District	Year														Mean	%
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987		
New Brunswick																
63	82	27	32	34	36	70	102	36	41	0	0	2	0	0	33.0	2.07
64	9	24	9	13	2	8	19	9	10	6	7	3	9	9	9.8	.61
65	29	15	12	1	49	50	23	4	3	2	13	12	14	75	21.6	1.35
66	21	30	23	16	13	4	22	19	14	26	29	23	38	37	22.5	1.41
67	8	84	84	98	105	27	51	77	11	28	19	17	49	38	49.7	3.12
68	47	60	88	124	145	176	197	181	164	107	127	62	96	66	117.1	7.35
70	162	138	306	426	186	186	228	331	293	90	71	78	134	94	194.5	12.21
71	75	42	52	71	105	124	194	328	413	85	85	102	220	160	146.9	9.22
73	2	142	117	122	137	157	152	134	220	82	79	80	28	26	105.6	6.63
75	26	13	22	10	30	19	11	33	85	22	19	36	25	35	24.7	1.55
76	52	78	115	39	43	107	124	31	135	85	125	156	277	331	121.3	7.61
77	89	108	160	100	109	201	303	181	565	101	68	40	623	610	232.7	14.61
78	75	61	158	105	186	239	31	88	5	12	8	9	12	4	70.9	4.45
80	28	23	20	21	15	66	91	21	13	6	21	16	18	18	26.9	1.69
Total	705	845	1198	1180	1161	1434	1548	1473	1932	652	671	636	1543	1503	1177.2	73.90
Gulf Nova Scotia																
2	3	2	1	3	2	1	0	2	2	2	3	4	1	0	1.9	.12
3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	.1	.00
10	2	0	0	0	0	1	0	0	3	0	0	0	0	0	.4	.03
11	12	7	0	3	5	2	0	6	2	1	2	1	5	5	3.6	.23
12	4	0	0	2	3	4	3	1	0	0	2	3	0	2	1.7	.11
13	8	6	5	1	1	3	0	0	0	3	0	1	14	4	3.3	.21
45	25	8	17	51	35	74	22	41	18	1	9	5	7	4	22.6	1.42
46	8	1	10	0	0	0	3	7	2	0	7	5	5	11	4.2	.26
Total	62	24	33	60	46	85	28	57	27	7	23	19	32	27	37.9	2.38
Prince Edward Island																
82	0	1	1	0	1	0	0	0	0	0	0	4	0	1	.6	.04
83	135	238	277	189	200	249	106	63	153	131	78	70	62	101	146.6	9.20
85	6	5	3	12	26	58	98	0	3	0	0	0	61	0	19.4	1.22
86	3	30	24	20	4	137	112	83	1	5	30	4	367	3	58.8	3.69
87	13	6	6	7	73	3	3	0	3	2	2	1	2	0	8.6	.54
88	101	89	203	151	36	31	9	9	70	24	12	8	11	23	55.5	3.48
92	42	28	11	19	9	14	25	110	5	93	112	10	15	7	35.7	2.24
93	14	32	10	15	20	40	38	37	35	5	4	19	15	10	21.0	1.32
95	16	24	19	30	26	20	17	20	24	1	0	2	151	3	25.2	1.58
96	5	8	13	16	6	8	2	0	4	0	7	0	19	2	6.4	.40
Total	335	461	567	459	401	560	410	322	298	261	245	118	703	150	377.9	23.72
Gulf Maritimes																
Total	1102	1330	1798	1699	1608	2079	1986	1852	2257	920	939	773	2278	1680	1592.9	100.00